

[Thesis Title]

[Afonso Santos Carapeto]

Thesis to obtain the Master of Science Degree in

[Scientific Field]

Supervisor: Prof. Lorem Ipsum
Prof. Lorem Ipsum

Examination Committee

Chairperson: Prof. Lorem Ipsum

Supervisor: Prof. Lorem Ipsum
Prof. Lorem Ipsum

Members of the Committee: Prof. Lorem Ipsum
Prof. Lorem Ipsum

[Month and Year]

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

Acknowledgements

Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

Abstract

Resumo e palavras-chave (em português e em inglês). O resumo analítico, também designado por resumo ou abstract, descreve o objectivo, o conteúdo do trabalho e as conclusões. Deve ser escrito em português e inglês, com um máximo de 250 palavras cada e acompanhado de 4 a 6 palavras-chave.

Keywords: Resumo, Palavras-Chave, Resumo Analítico

Resumo

The abstract describes the objective, the content of the project and the conclusions. It must be written in both portuguese and english, with a maximum of 250 words, accompanied by 4 to 6 keywords.

Palavras-Chave: Abstract

Contents

Contents	xi
List of Figures	xiii
List of Tables	xiv
Glossary	xv
Lista de Acrónimos	xvi
Lista de Símbolos	xvii
1 Introduction	1
1.1 Motivation	1
1.2 Requirements/who is this for	1
2 Solutions	3
2.1 Existing Solutions	3
2.2 Proposed Solutions	4
2.3 Basic Supporting Technologies	4
2.3.1 Communication Protocols	4
2.3.2 SPI Protocol	4
2.3.3 I2C Protocol	5
2.3.4 UART	6
2.3.5 SPI vs I2C vs UART	7
2.3.6 Display Choice	7
2.3.7 LCD	7
2.3.8 OLED	7
2.3.9 ePaper	7
2.4 Energy saving	8
3 Tests	9
4 Future Work	10

5 Conclusion	11
5.1 Primeira Secção	11
I Implementação e Resultados	13
II Bibliografia e Apêndices	16
Bibliography	17
A Primeiro Anexo	18
B Segundo Anexo	20

List of Figures

2.1	Hacker Hotel 2023 badge.	3
2.2	SPI.	4
2.3	I2C.	5
2.4	UART.	6
5.1	Imagem de exemplo.	11
5.2	Exemplo de um diagrama feito em \LaTeX	12
5.3	Exemplo de um gráfico em \LaTeX	12
5.4	Exemplo de um gráfico de dados em \LaTeX	14

List of Tables

2.1	Algumas expressões e variáveis. Nas tabelas, a legenda vem em cima.	8
5.1	Algumas expressões e variáveis. Nas tabelas, a legenda vem em cima.	12

Glossary

MATLAB *Software* de cálculo numérico

Lista de Acrónimos

PID proporcional-integral-derivativo

Lista de Símbolos

g Aceleração gravítica

ρ Densidade do ar

m Massa

Chapter 1

Introduction

1.1 Motivation

Electronic badges are present in multiple fields. There are a vast number of possible applications. Some of them are:

- **Networking and business events** - Attendee identification, control the secure areas within events, networking and data exchange between badges
- **Healthcare** - Patient identification in hospitals and clinics, monitoring and tracking healthcare workers and patients for safety and security
- **Tourism** - Keyless entry to hotel rooms or Airbnb accommodations, access to theme parks, concerts, and other entertainment events
- **Wharehousing** - Inventory management and order fulfillment
- **Fitness** - Monitoring and tracking athletes' performance and health, gamification of fitness activities to encourage physical activity
- **Entertainment and Gaming** - Collectible or interactive gaming badges at conventions and events, scavenger hunts and interactive experiences at theme parks
- **Marketing and Brand Promotion** - Collecting data on consumer behavior and preferences at trade shows and events, and personalized marketing and advertising based on that data

1.2 Requirements/who is this for

This electronic badge is aimed at new students entering IST, and it will have the following features:

- **Student Identification** - Name, Student ID, IST email, phone number and course. This data can be configured and altered by the user and also shared between users through IR

- **A treasure hunt game**, where students will explore the campus, and enter a code every time they encounter a new location
- **Games** - to be played on a small display and on a serial monitor when connected to a computer through USB

There are two extra, but fundamental requirements: the whole board shouldn't cost more than 10€, and it should be as energy efficient as possible, lasting at least around two days without being recharged.

It's important to keep a balance between the power consumption: the time the board lasts, the functionality, and the cost. The goal isn't to make a board that can run the most high-end games, if it is expensive and the battery runs out too fast. The opposite is also applicable, a board that lasts a lot of time, but doesn't give the user a good experience doesn't meet the requirements. So, the objective is to find a medium point, where some compromises are made in order to keep an overall balance and all requirements are met.

- **Using the board in the future**

Chapter 2

Solutions

2.1 Existing Solutions

It is crucial to recognize and analyze some of the current badges that have served as the foundation for this study as we delve into the world of electronic badges. These earlier badges serve as illustrations of comparable field implementations, offering insightful comparisons and standards against which our badge can be evaluated.

The first notable example is a badge built for Hacker Hotel, an annual technology and hacker conference that takes place in the Netherlands. For the 2023 edition, they designed a puzzle game in the board intended to entertain the visitors, taking them around the venue where the event took place, and to find clues to an eventual solution. The badge has a row of push buttons for users to input the binary codes of each clue. It uses an RP2040 microcontroller is powered by a CR2032 coin cell. One drawback of this badge is that it only has utility for the Hacker Hotel event, not anything beyond.

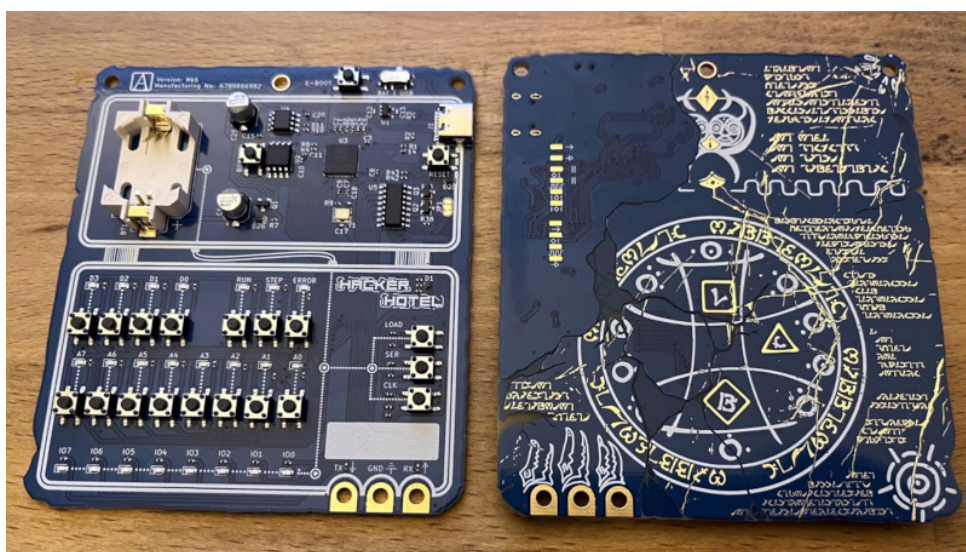


Figure 2.1: Hacker Hotel 2023 badge.

Another badge worth to be looked at is

Component	Quantity	Price
ATtiny85 SOIC-8 chip	1	-
I2C OLED Display 128x64px	1	-
Slide Switch	1	-
CR2032 coin cell	1	-
CR2032 holder	1	-
22k resistor	3	-
6mm push button	3	-
6 pin Female headers	1	-

2.2 Proposed Solutions

As for the input interface, one option is to put four directional arrow buttons, and an additional pair of buttons denoted as "A" and "B," serving as functional equivalents to "OK" and "Cancel. With this type of button interface, the student is allowed to do everything asked in the requirements - see and change personal information, play the treasure hunt game, and the normal games.

2.3 Basic Supporting Technologies

2.3.1 Communication Protocols

2.3.2 SPI Protocol

The Serial Peripheral Interface (SPI) works by using 4 lines:

- **MOSI (Master Output/Slave Input)** - Line that carries data from the Master to the Slave
- **MISO (Master Input/Slave Output)** - Line that carries data from the Slave to the Master
- **SCLK (Serial Clock)** - Clock line generated by the master device to synchronize data transfer
- **SS/CS - (Slave Select/Chip Select)** - Line used by the master to select the specific slave device it wants to communicate with.

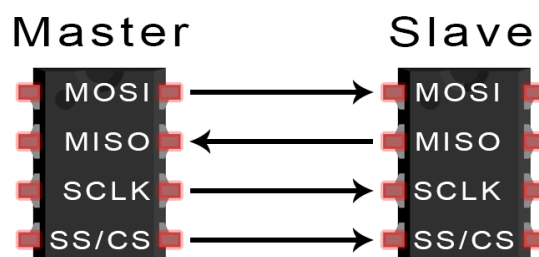


Figure 2.2: SPI.

The communication starts with the master assigning a slave to send data to. It does that by setting the SS/CS line to low. When it is in idle mode, not transmitting, the line is set to high. Then the master sends the clock signal to synchronize the output of data bits from the master to the sampling of bits by the slave (meaning this is a synchronous communication protocol). In each clock cycle, one bit of data is transmitted, so the speed of the communication is determined by the clock frequency. The data sent from the master to the slave is transmitted through the MOSI line, and it is usually sent with the most significant bit first. In the MISO line, the data is sent from the slave to the master, and usually with the least significant bit first. After the data transfer, the master changes the state of the SS/CS line, indicating the end of the communication with a particular slave.

2.3.3 I2C Protocol

Unlike the SPI protocol, the I2C (Inter-Integrated Circuit) protocol works using only 2 lines:

- **SDA (Serial Data)** - Line that carries data between the slave and the master
- **SCL (Serial Clock)** - Line that provides the clock signal that synchronizes data transfer.

The devices both transmit and receive data in the same line, the SDA. The data is transmitted in messages, that are composed of different frames (groups of bits). The message is composed of:

- **One start bit**, where the SDA line switches from 1 to 0
- **An address frame**, 7 or 10 bits that identify the slave with which the communication is being done
- **An ACK/NACK bit**, sent by the slave that the master wants to communicate to, to confirm if the slave received the address frame, by changing the SDA line from high to low.
- **The data frame**, which is always 8 bits, and sent starting with the most significant bit. It's also followed by an ACK/NACK bit. The message can have multiple data frames.
- **A stop bit** to end the message, sent by the master by switching the SDA line from 0 to 1.

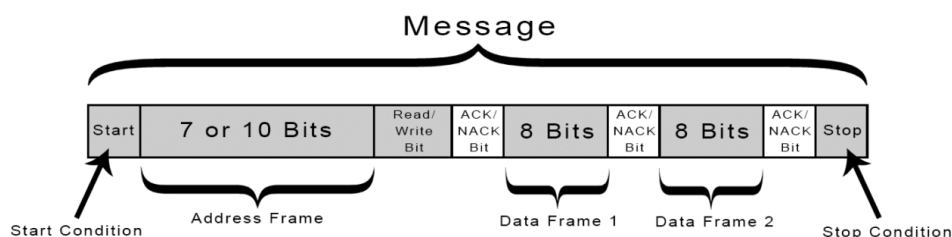


Figure 2.3: I2C.

2.3.4 UART

The UART (Universal Asynchronous Receiver/Transmitter) is not a communication protocol, unlike SPI and I2C, it is a physical circuit in a microcontroller whose purpose is to transmit and receive data.

UART uses 2 wires, connected to 2 pins:

- **Tx** - To transmit data
- **Rx** - To receive data

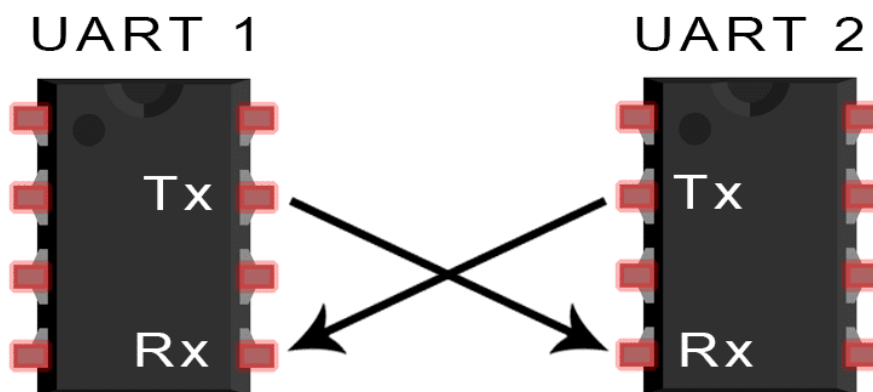


Figure 2.4: UART.

Data flows from the Tx pin to the Rx pin, and it doesn't use a clock signal, so it is an asynchronous communication method. To indicate the beginning and the end of the message, start and stop bits are added to the data frame. In order to be synchronized, the devices that are communicating configure the correspondent frequency at which the data is transmitted and received, which is called the baud rate, and must be the same in both devices.

The UART data packet is composed of:

- **Start bit** - The UART device pulls the transmission line from high to low, to indicate the start of the transmission
- **Data frame** - 5 to 8 bits sent from the least to the most significant bit, which contain the data that is being transmitted.
- **Parity bit** - The bits can be altered by electromagnetic radiation, different baud rates, long transmissions, so the parity bit allows the receiving device to know if the data has been corrupted during the transmission. It works by counting the number of 1s in the data frame. If that number is even, the parity bit must be zero; if the number is odd, the parity bit must be 1. The receiver then confirms if the parity bit and the number of 1 bits match
- **Stop bit** - The UART transmitting device pulls the line from high to low for at least two bits

2.3.5 SPI vs I2C vs UART

Both protocols have their advantages and disadvantages, which are important to consider. I2C is simpler in terms of wiring because it only uses 2 lines, unlike SPI which uses 4. However, this works in favor of the SPI protocol, because the MOSI and MISO lines enable the devices to receive and transmit data at the same time. Regarding slave addressing, the SPI protocol has a specific line for it, which makes it easier than sending the slave address in each message (even though in SPI, if multiple slaves are used, the master needs to have a different SS/CS pin for each one). SPI only supports one master, while I2C can have multiple master. Another difference between the two protocols is that SPI doesn't need start and stop bits, so it can stream data continuously. On the other hand, I2C has an ACK bit that confirms if the message was received correctly.

Energy saving is a big focus point in this project, so it's also crucial to analyze the difference in power consumption between each communication protocol.

Explicar tmb aqui a velocidade, por causa do open collector?

2.3.6 Display Choice

The two main goals are to keep the power consumption as low as possible, as well as the price of the board. Thus, it's important to choose the right display for this application, because it will be the most energy costly and the most expensive component. Various displays with various types of technologies were considered and compared (LCD, OLED and ePaper).

2.3.7 LCD

LCD (Liquid Crystal Display)

2.3.8 OLED

OLED (Organic Light Emitting Diode) One advantage that the OLED has over LCD displays is that it is thinner

2.3.9 ePaper

Another option to consider for the display is an ePaper display. The way they work is by utilizing a thin film of micro-capsules backed by an electrode panel. Each capsule contains millions of ink-particles that are electrically charged and suspended on clear fluid. By applying negative and positive charges to the electrodes the ink different ink particles get attracted or repelled, thus creating an image. This explains why these types of displays don't need power to maintain what is displayed on the screen. Only when the image changes does it require power.

Table 2.1: Algumas expressões e variáveis. Nas tabelas, a legenda vem em cima.

-	-	-
-	-	-
-	-	-
-	-	-

2.4 Energy saving

Chapter 3

Tests

Chapter 4

Future Work

Chapter 5

Conclusion

5.1 Primeira Secção

Esta referência liga à equação (5.1).

$$\mathbb{P}\left(\frac{X_1 + \cdots + X_n}{\sqrt{n}} \leq y\right) \rightarrow R(y) = \int_{-\infty}^y \frac{e^{-t^2/2}}{\sqrt{2\pi}} dt \quad \text{as } n \rightarrow \infty \quad (5.1)$$

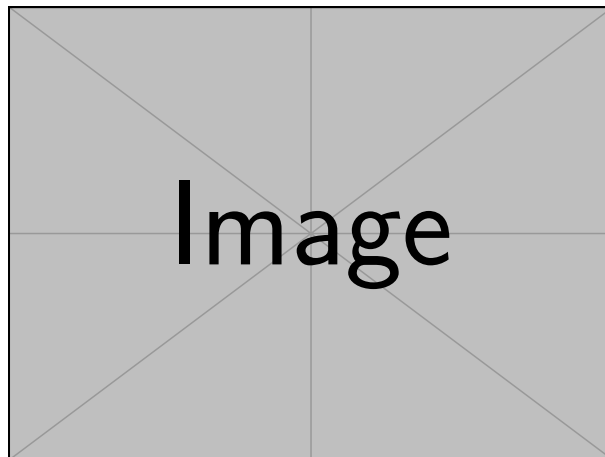


Figure 5.1: Imagem de exemplo.

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

Table 5.1: Algumas expressões e variáveis. Nas tabelas, a legenda vem em cima.

Função	Valor de x	Valor de y
$y = 4x$	67	268
$y = x^2$	13	169
$y = e^x$	9.5	33.115

Sed feugiat. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Ut pellentesque augue sed urna. Vestibulum diam eros, fringilla et, consectetur eu, nonummy id, sapien. Nullam at lectus. In sagittis ultrices mauris. Curabitur malesuada erat sit amet massa. Fusce blandit. Aliquam erat volutpat. Aliquam euismod. Aenean vel lectus. Nunc imperdiet justo nec dolor.

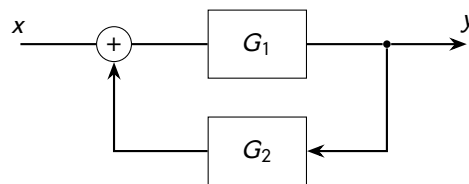


Figure 5.2: Exemplo de um diagrama feito em \LaTeX .

Aliquam lectus. Vivamus leo. Quisque ornare tellus ullamcorper nulla. Mauris porttitor pharetra tortor. Sed fringilla justo sed mauris. Mauris tellus. Sed non leo. Nullam elementum, magna in cursus sodales, augue est scelerisque sapien, venenatis congue nulla arcu et pede. Ut suscipit enim vel sapien. Donec congue. Maecenas urna mi, suscipit in, placerat ut, vestibulum ut, massa. Fusce ultrices nulla et nisl.

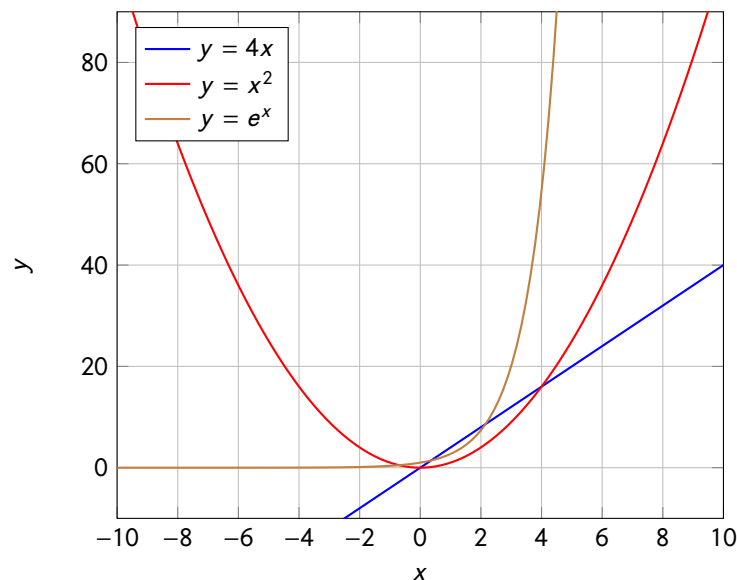


Figure 5.3: Exemplo de um gráfico em \LaTeX .

Part I

Implementação e Resultados

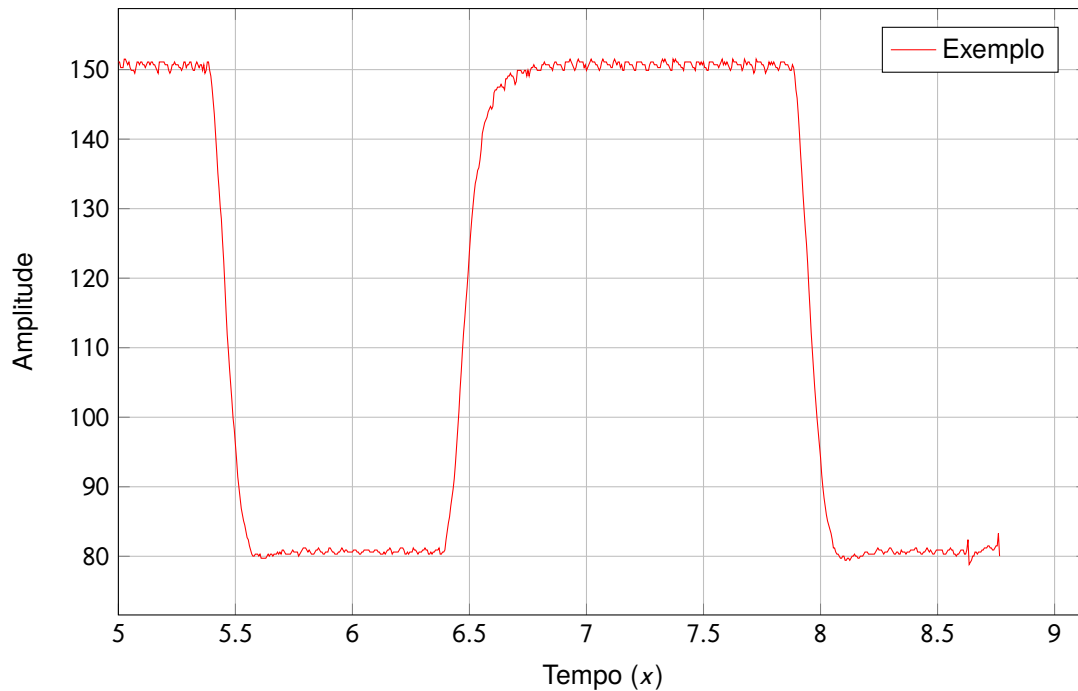


Figure 5.4: Exemplo de um gráfico de dados em \LaTeX . Os dados foram obtidos de um ficheiro .csv externo.

Nulla in ipsum. Praesent eros nulla, congue vitae, euismod ut, commodo a, wisi. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Aenean nonummy magna non leo. Sed felis erat, ullamcorper in, dictum non, ultricies ut, lectus. Proin vel arcu a odio lobortis euismod. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Proin ut est. Aliquam odio. Pellentesque massa turpis, cursus eu, euismod nec, tempor congue, nulla. Duis viverra gravida mauris. Cras tincidunt. Curabitur eros ligula, varius ut, pulvinar in, cursus faucibus, augue.

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

Nulla malesuada porttitor diam. Donec felis erat, congue non, volutpat at, tincidunt tristique, libero.

Vivamus viverra fermentum felis. Donec nonummy pellentesque ante. Phasellus adipiscing semper elit. Proin fermentum massa ac quam. Sed diam turpis, molestie vitae, placerat a, molestie nec, leo. Maecenas lacinia. Nam ipsum ligula, eleifend at, accumsan nec, suscipit a, ipsum. Morbi blandit ligula feugiat magna. Nunc eleifend consequat lorem. Sed lacinia nulla vitae enim. Pellentesque tincidunt purus vel magna. Integer non enim. Praesent euismod nunc eu purus. Donec bibendum quam in tellus. Nullam cursus pulvinar lectus. Donec et mi. Nam vulputate metus eu enim. Vestibulum pellentesque felis eu massa.

Quisque ullamcorper placerat ipsum. Cras nibh. Morbi vel justo vitae lacus tincidunt ultrices. Lorem ipsum dolor sit amet, consectetur adipiscing elit. In hac habitasse platea dictumst. Integer tempus convallis augue. Etiam facilisis. Nunc elementum fermentum wisi. Aenean placerat. Ut imperdiet, enim sed gravida sollicitudin, felis odio placerat quam, ac pulvinar elit purus eget enim. Nunc vitae tortor. Proin tempus nibh sit amet nisl. Vivamus quis tortor vitae risus porta vehicula.

Fusce mauris. Vestibulum luctus nibh at lectus. Sed bibendum, nulla a faucibus semper, leo velit ultricies tellus, ac venenatis arcu wisi vel nisl. Vestibulum diam. Aliquam pellentesque, augue quis sagittis posuere, turpis lacus congue quam, in hendrerit risus eros eget felis. Maecenas eget erat in sapien mattis porttitor. Vestibulum porttitor. Nulla facilisi. Sed a turpis eu lacus commodo facilisis. Morbi fringilla, wisi in dignissim interdum, justo lectus sagittis dui, et vehicula libero dui cursus dui. Mauris tempor ligula sed lacus. Duis cursus enim ut augue. Cras ac magna. Cras nulla. Nulla egestas. Curabitur a leo. Quisque egestas wisi eget nunc. Nam feugiat lacus vel est. Curabitur consectetur.

Suspendisse vel felis. Ut lorem lorem, interdum eu, tincidunt sit amet, laoreet vitae, arcu. Aenean faucibus pede eu ante. Praesent enim elit, rutrum at, molestie non, nonummy vel, nisl. Ut lectus eros, malesuada sit amet, fermentum eu, sodales cursus, magna. Donec eu purus. Quisque vehicula, urna sed ultricies auctor, pede lorem egestas dui, et convallis elit erat sed nulla. Donec luctus. Curabitur et nunc. Aliquam dolor odio, commodo pretium, ultricies non, pharetra in, velit. Integer arcu est, nonummy in, fermentum faucibus, egestas vel, odio.

Sed commodo posuere pede. Mauris ut est. Ut quis purus. Sed ac odio. Sed vehicula hendrerit sem. Duis non odio. Morbi ut dui. Sed accumsan risus eget odio. In hac habitasse platea dictumst. Pellentesque non elit. Fusce sed justo eu urna porta tincidunt. Mauris felis odio, sollicitudin sed, volutpat a, ornare ac, erat. Morbi quis dolor. Donec pellentesque, erat ac sagittis semper, nunc dui lobortis purus, quis congue purus metus ultricies tellus. Proin et quam. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos. Praesent sapien turpis, fermentum vel, eleifend faucibus, vehicula eu, lacus.

Part II

Bibliografia e Apêndices

Bibliography

- [1] $T_{\text{E}}X$ – \LaTeX Stack Exchange. URL: <https://tex.stackexchange.com/> (visited on 11/17/2018).
- [2] Palle Jørgensen. *The \LaTeX Font Catalogue*. URL: <http://www.tug.dk/FontCatalogue/> (visited on 10/14/2018).
- [3] Frank Mittelbach et al. *The \LaTeX Companion*. 2nd ed. Addison-Wesley, 2004. ISBN: 0-201-36299-6.
- [4] CTAN Team. *The Comprehensive $T_{\text{E}}X$ Archive Network*. URL: <https://ctan.org/> (visited on 11/17/2018).
- [5] *Wikibooks \LaTeX textbook*. Wikibooks. URL: <https://en.wikibooks.org/wiki/LaTeX> (visited on 10/14/2018).

Appendix A

Primeiro Anexo

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

Nulla malesuada porttitor diam. Donec felis erat, congue non, volutpat at, tincidunt tristique, libero. Vivamus viverra fermentum felis. Donec nonummy pellentesque ante. Phasellus adipiscing semper elit. Proin fermentum massa ac quam. Sed diam turpis, molestie vitae, placerat a, molestie nec, leo. Maecenas lacinia. Nam ipsum ligula, eleifend at, accumsan nec, suscipit a, ipsum. Morbi blandit ligula feugiat magna. Nunc eleifend consequat lorem. Sed lacinia nulla vitae enim. Pellentesque tincidunt purus vel magna. Integer non enim. Praesent euismod nunc eu purus. Donec bibendum quam in tellus. Nullam cursus pulvinar lectus. Donec et mi. Nam vulputate metus eu enim. Vestibulum pellentesque felis eu massa.

Quisque ullamcorper placerat ipsum. Cras nibh. Morbi vel justo vitae lacus tincidunt ultrices. Lorem ipsum dolor sit amet, consectetur adipiscing elit. In hac habitasse platea dictumst. Integer tempus convallis augue. Etiam facilisis. Nunc elementum fermentum wisi. Aenean placerat. Ut imperdiet, enim sed gravida sollicitudin, felis odio placerat quam, ac pulvinar elit purus eget enim. Nunc vitae tortor. Proin

tempus nibh sit amet nisl. Vivamus quis tortor vitae risus porta vehicula.

Fusce mauris. Vestibulum luctus nibh at lectus. Sed bibendum, nulla a faucibus semper, leo velit ultricies tellus, ac venenatis arcu wisi vel nisl. Vestibulum diam. Aliquam pellentesque, augue quis sagittis posuere, turpis lacus congue quam, in hendrerit risus eros eget felis. Maecenas eget erat in sapien mattis porttitor. Vestibulum porttitor. Nulla facilisi. Sed a turpis eu lacus commodo facilisis. Morbi fringilla, wisi in dignissim interdum, justo lectus sagittis dui, et vehicula libero dui cursus dui. Mauris tempor ligula sed lacus. Duis cursus enim ut augue. Cras ac magna. Cras nulla. Nulla egestas. Curabitur a leo. Quisque egestas wisi eget nunc. Nam feugiat lacus vel est. Curabitur consectetur.

Suspendisse vel felis. Ut lorem lorem, interdum eu, tincidunt sit amet, laoreet vitae, arcu. Aenean faucibus pede eu ante. Praesent enim elit, rutrum at, molestie non, nonummy vel, nisl. Ut lectus eros, malesuada sit amet, fermentum eu, sodales cursus, magna. Donec eu purus. Quisque vehicula, urna sed ultricies auctor, pede lorem egestas dui, et convallis elit erat sed nulla. Donec luctus. Curabitur et nunc. Aliquam dolor odio, commodo pretium, ultricies non, pharetra in, velit. Integer arcu est, nonummy in, fermentum faucibus, egestas vel, odio.

Sed commodo posuere pede. Mauris ut est. Ut quis purus. Sed ac odio. Sed vehicula hendrerit sem. Duis non odio. Morbi ut dui. Sed accumsan risus eget odio. In hac habitasse platea dictumst. Pellentesque non elit. Fusce sed justo eu urna porta tincidunt. Mauris felis odio, sollicitudin sed, volutpat a, ornare ac, erat. Morbi quis dolor. Donec pellentesque, erat ac sagittis semper, nunc dui lobortis purus, quis congue purus metus ultricies tellus. Proin et quam. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos. Praesent sapien turpis, fermentum vel, eleifend faucibus, vehicula eu, lacus.

Appendix B

Segundo Anexo

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

Nulla malesuada porttitor diam. Donec felis erat, congue non, volutpat at, tincidunt tristique, libero. Vivamus viverra fermentum felis. Donec nonummy pellentesque ante. Phasellus adipiscing semper elit. Proin fermentum massa ac quam. Sed diam turpis, molestie vitae, placerat a, molestie nec, leo. Maecenas lacinia. Nam ipsum ligula, eleifend at, accumsan nec, suscipit a, ipsum. Morbi blandit ligula feugiat magna. Nunc eleifend consequat lorem. Sed lacinia nulla vitae enim. Pellentesque tincidunt purus vel magna. Integer non enim. Praesent euismod nunc eu purus. Donec bibendum quam in tellus. Nullam cursus pulvinar lectus. Donec et mi. Nam vulputate metus eu enim. Vestibulum pellentesque felis eu massa.

Quisque ullamcorper placerat ipsum. Cras nibh. Morbi vel justo vitae lacus tincidunt ultrices. Lorem ipsum dolor sit amet, consectetur adipiscing elit. In hac habitasse platea dictumst. Integer tempus convallis augue. Etiam facilisis. Nunc elementum fermentum wisi. Aenean placerat. Ut imperdiet, enim sed gravida sollicitudin, felis odio placerat quam, ac pulvinar elit purus eget enim. Nunc vitae tortor. Proin

tempus nibh sit amet nisl. Vivamus quis tortor vitae risus porta vehicula.

Fusce mauris. Vestibulum luctus nibh at lectus. Sed bibendum, nulla a faucibus semper, leo velit ultricies tellus, ac venenatis arcu wisi vel nisl. Vestibulum diam. Aliquam pellentesque, augue quis sagittis posuere, turpis lacus congue quam, in hendrerit risus eros eget felis. Maecenas eget erat in sapien mattis porttitor. Vestibulum porttitor. Nulla facilisi. Sed a turpis eu lacus commodo facilisis. Morbi fringilla, wisi in dignissim interdum, justo lectus sagittis dui, et vehicula libero dui cursus dui. Mauris tempor ligula sed lacus. Duis cursus enim ut augue. Cras ac magna. Cras nulla. Nulla egestas. Curabitur a leo. Quisque egestas wisi eget nunc. Nam feugiat lacus vel est. Curabitur consectetur.

Suspendisse vel felis. Ut lorem lorem, interdum eu, tincidunt sit amet, laoreet vitae, arcu. Aenean faucibus pede eu ante. Praesent enim elit, rutrum at, molestie non, nonummy vel, nisl. Ut lectus eros, malesuada sit amet, fermentum eu, sodales cursus, magna. Donec eu purus. Quisque vehicula, urna sed ultricies auctor, pede lorem egestas dui, et convallis elit erat sed nulla. Donec luctus. Curabitur et nunc. Aliquam dolor odio, commodo pretium, ultricies non, pharetra in, velit. Integer arcu est, nonummy in, fermentum faucibus, egestas vel, odio.

Sed commodo posuere pede. Mauris ut est. Ut quis purus. Sed ac odio. Sed vehicula hendrerit sem. Duis non odio. Morbi ut dui. Sed accumsan risus eget odio. In hac habitasse platea dictumst. Pellentesque non elit. Fusce sed justo eu urna porta tincidunt. Mauris felis odio, sollicitudin sed, volutpat a, ornare ac, erat. Morbi quis dolor. Donec pellentesque, erat ac sagittis semper, nunc dui lobortis purus, quis congue purus metus ultricies tellus. Proin et quam. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos. Praesent sapien turpis, fermentum vel, eleifend faucibus, vehicula eu, lacus.

[Thesis Title]

[Afonso Santos Carapeto]